MATRIX DRIFT-DIFFUSION MODEL AND SPIN TRANSISTOR: ISSUES RELATED TO APPLICATION OF THE MODEL

In the seminar in the previous semester I reported about analytical and 1D numerical studies of the model describing transport of spin in semiconductors (the model was first proposed in [1]). The results of this work were also collected and submitted in our paper [2]. The next objective of my work is application of considered model to a real physical problem (not the toy one). An interesting application could be spin transistor (Datta-Das transistor) [3], which is a transistor (current amplifier or switcher) based on exploiting of spin of electron.

For studying of spin transistor, first of all, an extension of the current model is necessary because it does not describe spin-orbit interaction – an effect crucial for functioning of spin transistor. Also numerical solution with finite volumes in 2D should be more realistic compared to 1D implementation. These two issues will be discussed during my talk.

References

[1] S. Possanner and C. Negulescu. Diffusion limit of a generalized matrix Boltzmann equation for spin-polarized transport. *Kinetic Related Models* 4 (2011), 1159-1191.

[2] A. Jüngel, C. Negulescu, P. Shpartko. Bounded weak solutions to a matrix drift-diffusion model for spin-coherent electron transport in semiconductors, Preprint (2013) arXiv:1312.2461.

[3] S. Datta, B. Das. Electronic analog of the electrooptic modulator. *Appl. Phys. Lett.* 56 (1990), 665-667.